THE OFFICE ACTION

In the Final Office Action issued on September 9, 2004, the Examiner rejected claims 1-4, 9, and 10 under 35 U.S.C. §102(a) as being anticipated by WO 00/49452 to Kumar et al. ("Kumar"). The Examiner further rejected claims 1-4, 9 and 10 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,203,723 to Hsu ("Hsu"). The Examiner further rejected claims 5, 7 and 8 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of U.S. Patent No. 6,208,398 to Scherer ("Scherer"). The Examiner further rejected claims 5-8 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of U.S. Patent No. 6,512,569 to Acosta et al. ("Acosta"). The Examiner further rejected claims 5-7 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of UK Patent No. 2,329,481 to Molsen et al. ("Molsen"). The Examiner further indicated that claims 11-23 are allowed.

REMARKS

Applicants have carefully considered the Office Action issued on September 9, 2004. Applicants respectfully request reconsideration of the application in light of the following comments. Claims 1-23 remain pending in the application.

A. The Pending Claims Are Not Anticipated by Kumar

The Examiner rejected claims 1-4, 9, and 10, under 35 U.S.C. §102(a) as being anticipated by Kumar. Applicants respectfully traverse.

The present invention is directed to the formation of micro-structures such as, e.g., microwalls. As amended, claim 1 now recites that these micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures.

The phase separation that occurs as the prepolymer polymerizes in the presence of a spatially modulated liquid crystal director field and the distortions produced therefrom results in the formation of the polymer micro-structures. That is,

it is the inhomogeneity of the director field that determines the position and shape of the micro-structures. It should be noted that the polymerization of the prepolymer is not effected until the desired director structure is achieved, such as by the application of a voltage across the electrodes.

First, Kumar fails to disclose a liquid crystal device having polymer micro-structures formed between the substrates wherein the micro-structures have a shape and spatial location determined by the director field and wherein the micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures. In this respect, Kumar discloses electro-optic devices having phase separated composite structure with adjacent regions of polymer and liquid crystal ("LC"). The devices have LC microstructures, rather than polymer microstructures (see page 16, lines 30-32). In addition, the position and shape of the polymer and LC layers is determined by the application of UV light. Specifically, the cell is exposed to a UV light after being filled with the LC/polymer mixture, resulting in phase separation. The shape and configuration of the respective LC and polymer layers is determined by the UV light. This is clearly stated in Kumar, where it states "the desired LC/polymer configuration can be formed in exposed areas, unexposed areas or in both depending on the sample thickness, concentration of LC, size of light exposed area, and UV intensity." (page 8, lines 11-13). The light exposed and unexposed areas can in turn be controlled by the use of a photomask.

Thus, rather than the shape of the polymer structure being determined by the director field of the LC, the orientation of the two phases are determined by the application of UV light. In this respect Kumar clearly indicates "the photomask 32 may be used to generate microstructures" [in the LC] (page 10, line 21).

Alternately, Kumar uses a collimated beam or intereference pattern of laser beams 38. Polymerization occurs in areas where the beam impinges upon the mixture 30, resulting in formation of the microstructures where the beam does not impinge. (page 10, lines 12-16) Again, it is the radiation, rather than the LC director field that determines the shape and location of the polymer structures.

With reference to figure 6 of Kumar, an interface 60 is formed between an LC region 54 and a portion of the polymer material 58. Despite the Examiner's assertion, the polymer region 58 is not a microstructure, as that term is used in the present invention. In addition, the shape of this interface is determined by the materials used in the mixture, the alignment layer, the rate of diffusion of LC and polymer molecules, the spacing of the substrates, the photomask, the rate of polymerization and how it is initiated. It is NOT determined by the director field of the LC.

Thus, because Kumar fails to disclose polymer microstructures whose shape and spatial location determined by the director field of the LC or wherein the micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures, it fails to anticipate the present claims.

B. The Pending Claims are not Anticipated by Hsu

The Examiner rejected claims 1-4, 9, and 10 under 35 U.S.C. §102(b) as being anticipated by Hsu. Applicants respectfully traverse.

As with the Kumar reference above, Hsu discloses a LC/polymer film comprising a liquid crystal capsule containing a polymer network structure. However, Hsu fails to disclose polymer microstructures whose shape and spatial location determined by the director field of the LC and wherein the micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures. In this respect, Hsu discloses that the film containing the substrates and the LC capsule are exposed to UV light, which cures the prepolymer in the capsule to form a polymer network (col. 7, lines 7-9). Again, however, it is the application of UV light that determines the spatial location of the polymer structure. Hsu specifically states that the LC director is in fact induced by the configuration of the polymer network, rather than the other way around (col. 7, line 60-62). Further evidence of this can be seen

where Hsu states "the UV-curable prepolymer forms a web-like structure 9 and induce[s] nematic director assuming a polydomain configuration." (col. 8, lines 4-6).

Thus, because Hsu fails to disclose all of the elements of the present claims, it fails to anticipate the present claims.

C. The Pending Claims are not Obvious over Hsu in view of Scherer, Acosta or Molsen

The Examiner rejected claims 5, 7 and 8 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of Scherer. The Examiner further rejected claims 5-8 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of Acosta. The Examiner further rejected claims 5-7 under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of Molsen. Applicants respectfully traverse.

The disclosure of Hsu is described above. It is noted that Hsu fails to disclose the presence of polymer micro-structures having a shape and location determined by the liquid crystal director field and wherein the micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures.

The Examiner cites Scherer, Acosta, and Molsen all for the proposition that they all teach an alignment layer producing a homogenous planar geometry of the LC. Even assuming the correctness of this assertion for purposes of argument and even further assuming the propriety of combining Hsu with one or more of these references, the proposed combinations would still not disclose or suggest all of the elements of the present claims. In this respect, none of Hsu, Scherer, Acosta or Molsen disclose or suggest such micro-structures. Thus, any proposed combination of such references would also fail to suggest such a LC device.

Molsen, for instance, discloses a liquid crystal and polymer network in the liquid crystal cell. The polymer therein may have a network structure (pg. 5) due to crosslinking, but the polymer does not possess micro-structures having a shape and location determined by the liquid crystal director field or wherein the micro-structures are formed by causing the liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director and

thereafter polymerizing the prepolymer material to form a polymer with defined micro-structures. In fact, and with reference to figures 4, 7, and 8 therein, the polymer network appears to have a random but uniform orientation. The shape and positions of the polymer structure is not affected by the director field, since the director field in each reference is uniform and homogenous throughout the space between the substrates.

Because none of the proposed combinations disclose a liquid crystal device having polymer micro-structures having a shape and location determined by the liquid crystal director field, Applicants respectfully request withdrawal of the rejections based on the proposed combinations.

CONCLUSION

In view of the foregoing comments, Applicants submit that claims 1-23 are in condition for allowance. Applicants respectfully request early notification of such allowance. Should any issues remain unresolved, the Examiner is encouraged to contact the undersigned to attempt to resolve any such issues.

If any fee is due in conjunction with the filing of this response, Applicants authorize deduction of that fee from Deposit Account 06-0308.

Respectfully submitted,

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